DOCUMENT RESUME

ED 187 061 EC 124 326

AUTHOR Miller, Joy E.; Calkin, Abigail B.
TITLE Using Precision Teaching in a Secondary Science Class.
PUB DATE Apr 80
NOTE 18p.; Paper presented at the Annual International Convention of The Council for Exceptional Children (58th, Philadelphia, PA, April, 1980, Session W-66). Pages 2 and 13 of the original document were removed due to marginal legibility.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Disabilities; *Precision Teaching; *Science Instruction; Secondary Education; Teaching Methods

ABSTRACT

The advantages of using precision teaching in a secondary level special education science class are discussed. Among benefits considered are providing the student and teacher with a daily progress check, allowing the student an opportunity to use science vocabulary, evaluating individualized methods and materials, providing information on changing circumstances outside the classroom, and acting as a measure of teacher accountability. (CL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED187061

Using Precision Teaching in a Secondary Science Class

by

Joy E. Miller

Science Teacher

and

Abigail B. Calkin

Assistant Principal

Capital City Schools
2700 West Sixth
Topeka, Kansas 66606

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Joy E. Miller

Abigail B. Calkin

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

EC124326

This paper will discuss the benefits of using precision teaching in a Personal-Social Adjustment (PSA) special education secondary science class, grades 7 through 12. These benefits include providing 1) the student and teacher with a daily progress check; 2) the student with an opportunity to use science vocabulary; 3) teacher evaluation of individualized methods and materials; 4) learning pictures which may over time be related to other behaviors; and 5) a measure of accountability for the teacher.

The teacher used precision teaching in each of her science classes. The students had been enrolled in secondary science from zero to four years. There were a maximum of eight students per class, with reading levels from second to twelfth grade. Because the students were grouped heterogeneously, up to six different levels of science courses were taught within a 50 minute class period.

Daily Progress Checks

Precision teaching requires daily timings and recordings to measure a student's speed and accuracy in learning and provides the student and the teacher with progress information. Each day each student did a one minute timing, stating as many responses as he/she could. Each student then charted the corrects and errors on the Standard Celeration Chart (see Figure 1). The correct responses were charted with a dot and the incorrect responses were charted with an x. When the student had 10 days of frequency, the teacher drew the celeration line. This line best represented the trend of the data, the trend of the learning across time. The celeration lines drawn for corrects and for errors, formed a learning picture. This learning picture showed the accuracy in learning.

Through charting the science vocabulary the students were able to get an idea of how fast they were learning. Also, by looking at these learning pictures the teacher was able to make decisions about individual changes to be made.

There are four kinds of learning pictures: maximally improving, improving, maintaining, and worsening. Each of the different pictures within these categories are shown in Figure 2.

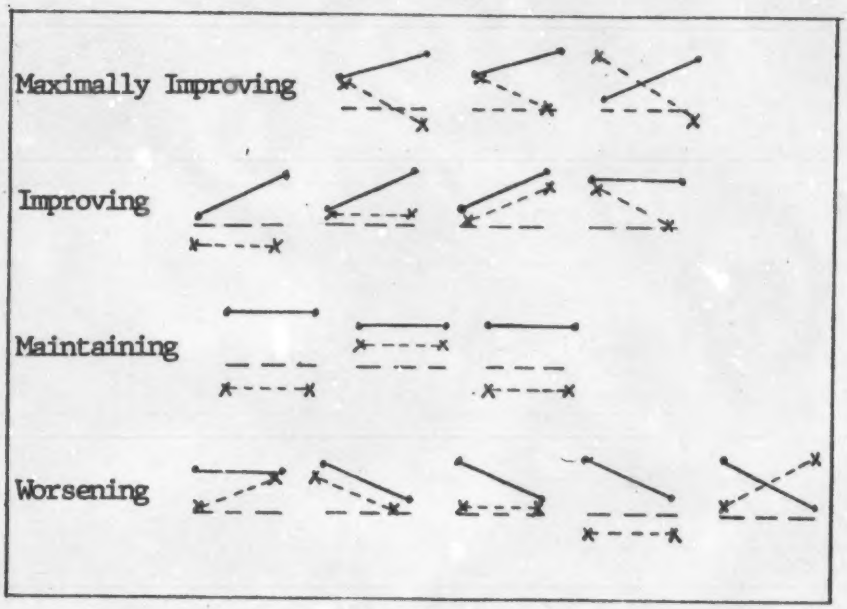

Figure 2. The different kinds of learning pictures.

Opportunities to Use Science Vocabulary

Learning science vocabulary is similar to learning a foreign language. Many words used in science have a foreign sound and must be used repeatedly to understand and retain their meaning. The various activities used were designed to increase each student's vocabulary. We started with naming 53 pieces of science equipment and supplies frequently used in the laboratory. The intent was to familiarize the students with the different lab pieces they

would be using. The teacher laid all the equipment out on the table. The students identified the equipment as quickly as they could-- stethoscope, test tube, filter paper, beaker, alcohol burner, flask, geranium, meal worm, spatula, depression slide-- 53 pieces of equipment. If they completed naming them they would go through them again. From this activity the students would then chart the number correct and the number wrong. Figure 3 is Greg. On the first day of the 53 pieces of equipment items, he knew approximately 10, indicated by the dot. As the days went on his correct responses increased to approximately 80. From the learning line we can see that Greg is learning the science equipment. For each day, he also charted his misses or his skips, indicated with the X's. In the beginning Greg did not know 40 of the pieces of equipment, but the chart shows he was able to decrease his errors and skips to zero. The dotted line indicates that he was timed for a minute in performing this activity and the marks below the line indicate he had zero errors.

During the second activity the students named 11 basic parts of the microscope and 19 major bones of a skeleton model. The skeleton and the microscope had red tape on the parts the students identified. Again, the students were given one minute to point to and name each marked part or bone. Looking at Greg's progress on the microscope and skeleton the corrects increased. The errors did not drop as rapidly, perhaps because the teacher was not consistent in the charted days. The errors, or skips, did finally drop to two.

The third activity of first semester involved reading questions on the front of flash cards and responding with single word answers on the back of

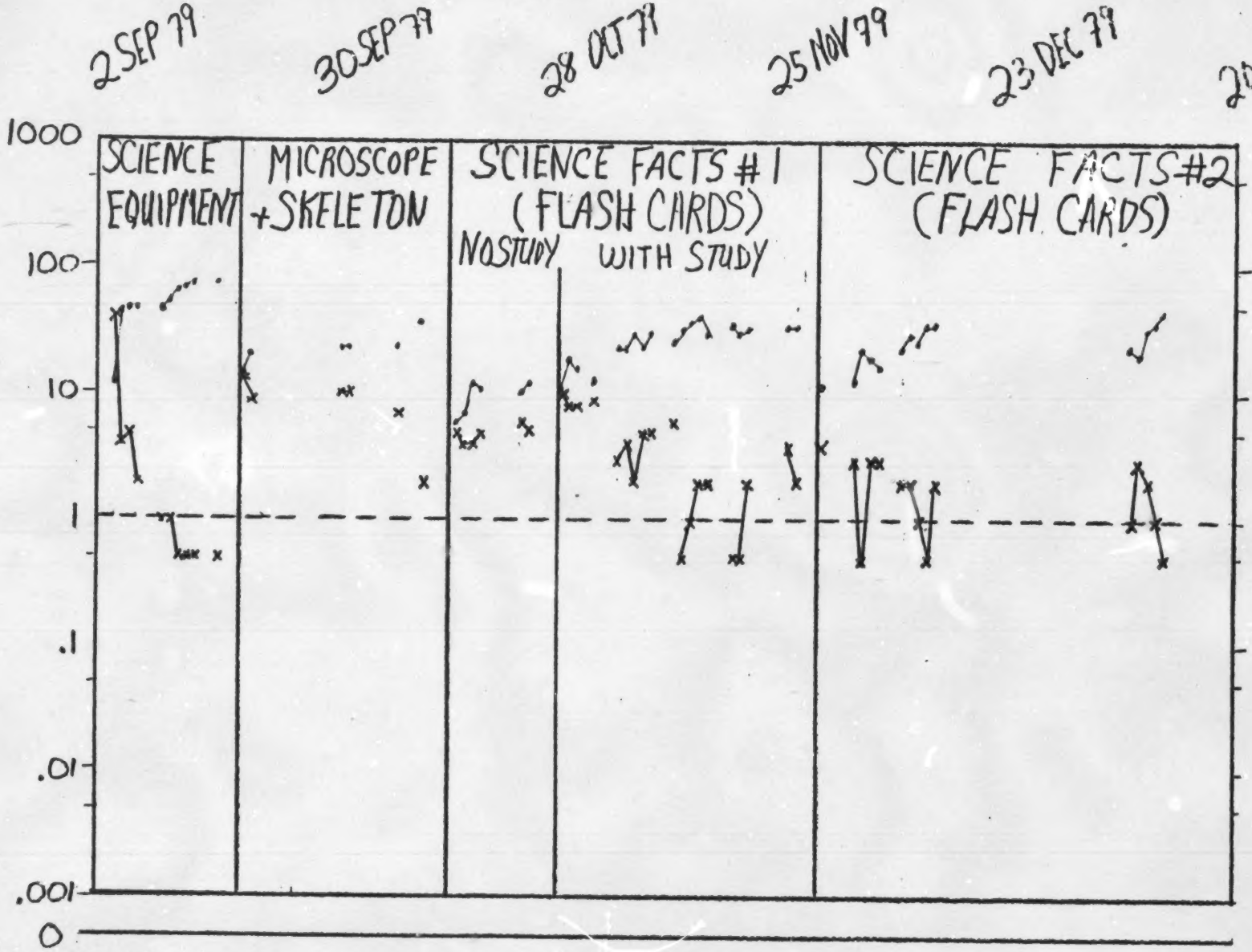

FIGURE 3.

A. CALKIN A. CALKIN J. MILLER GREG 16 10th gr. SCI. SKILLS

CAPITAL CITY SCHOOLS, TOPEKA, KS. GREG/J. MILLER GREG

the card. The science fact questions probed for general information needed for most of the science curricula to which the students were assigned. Samples of the questions include: 1) What is the metric unit for length? 2) What is the magnification of a microscope with a x10 eyepiece and a x40 objective lens? 3) What is the name for the study of living things? 4) Name the part of the cell which controls a cell's life processes.

The teacher first used the flash cards with no study hoping that by reading the cards day after day and seeing the answer each student would learn this information. As we see in Figure 3, Greg's learning flattened out with no study. The teacher later added 5 minutes of study and we see the learning increasing more rapidly, about x1.4 per week. As we look at these learning pictures, we're looking for what we call the learning jaws-- the student's correct responses going up and the incorrect responses dropping down. After about 5 days the students begin to see the jaws and realize that they're learning.

The fourth activity was then individualized to match the area of science in which the student was working and to intervene if he/she had not had a successful experience in the third activity. One group of students, who were studying biology, were timed on a second set of science fact cards, which contained questions specifically related to the material discussed in their textbook. A second group of students, who were studying life science, were timed on naming the organs of the various systems in the human body. The students had diagrams of the digestive system, nervous system, excretory system, and respiratory system with arrows indicating each organ to be named. A third group of students, who were using a primary

level workbook, Land Animals, were timed on spelling the various animals which they were studying. Each correct letter placed in the appropriate blank was counted as a correct response.

Some students, such as Greg, continued with a second set of flash cards. Again Greg's corrects are going up and the incorrects are going down, forming a learning jaws.

Evaluating Individualized Methods and Materials

The importance of keeping in touch with each student in an individualized class cannot be overemphasized. Evaluating student work and providing daily feedback is often delayed in the chaos of setting out the lab equipment for some students, helping others read their text, answering questions, and establishing structure for the behavior problems of these PSA students. Individualizing helps some students advance rapidly while others need easier material or a slower pace.

The learning pictures for Greg (see Figure 3) indicate his learning was maximally improving in four of the five phases. Greg's greatest improvement occurred in the first phase. His corrects increased by x1.6 and his errors decreased by ÷8. During the phase of learning science facts without study. Greg's learning was improving, but not maximally improving.

One may arrive at several conclusions concerning Greg's learning by reviewing his Standard Celeration Chart and the celeration lines. First, Greg learned during all phases. For example, when studying the science equipment, he started knowing 11 items and skipping or incorrectly naming 42 items. After two weeks, he was able to correctly name 76 items

(repeated some of the original 53 in one minute) and had no skips or incorrects. Second, regular attendance and timings effect the steepness of the celeration lines. Greg was timed periodically during the second phase, in microscope and skeleton. This inconsistant pattern more than likely prevented Greg from achieving steeper improvement. Third, Greg's learning reached maximal improvement when provided time to study. This conclusion was drawn from the learning pictures shown in phase 3, science facts #1. Learning was improving without study, but improved more rapidly with study time. Other students were having problems with the facts so we individualized. Brian is one example.

The learning pictures on Brian's Standard Celeration Chart (see Figure 4) indicate that during phases 1 and 2 he showed maximal improvement. The two learning pictures during science facts provide the teacher with the information that these phases were difficult for Brian. It took four weeks of one minute timings (including no study and with study phases) before he reached the crossover point, the point where he had more correct responses than incorrect responses. Noting the extended amount of time for Brian to reach the crossover point and observing his frustrations with the science fact cards, the teacher made the decision to switch Brian to a less frustrating learning experience. During phase 4, systems and organs, Brian's corrects and errors crossed over within one week of timings.

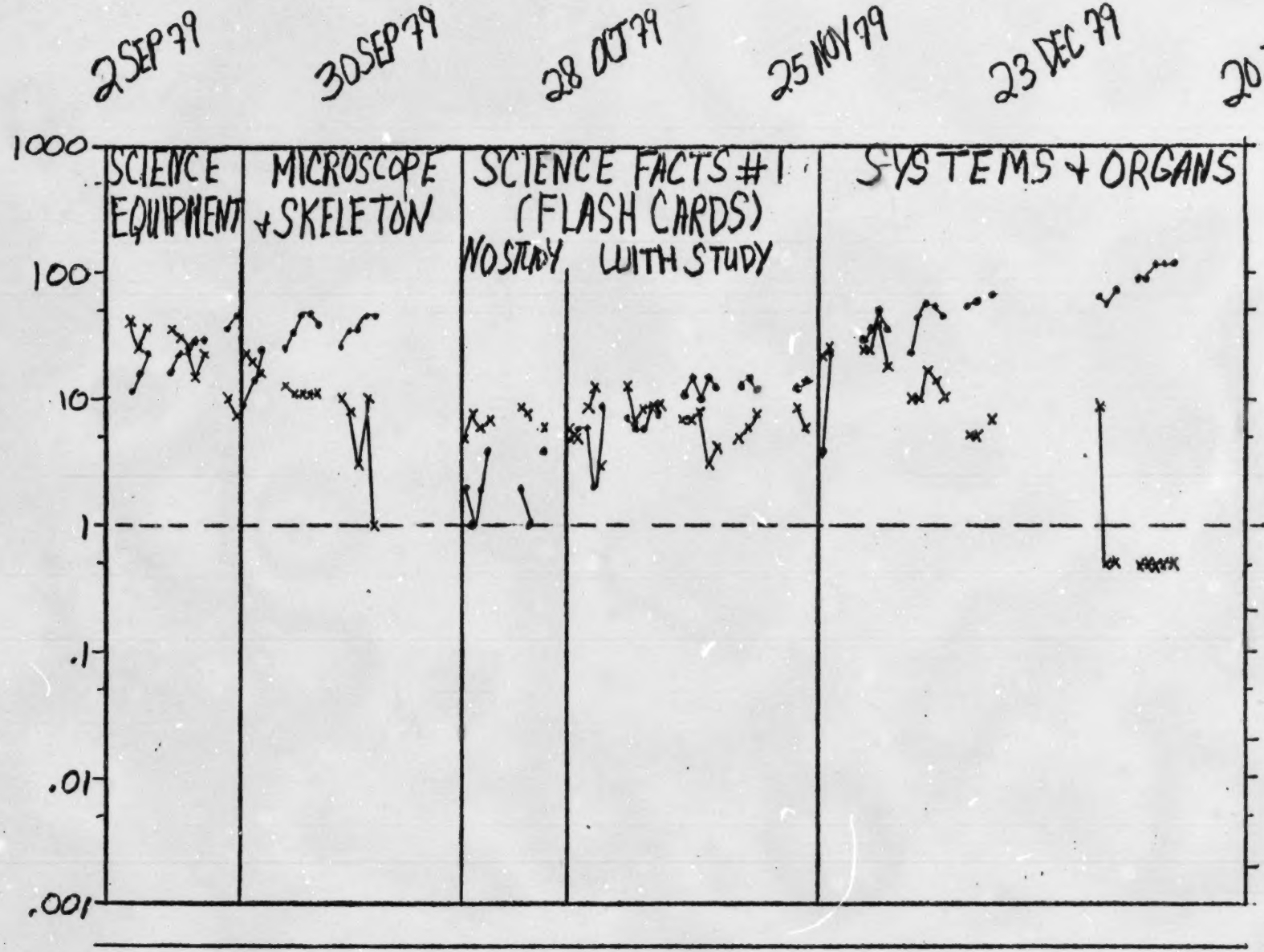

FIGURE 4.

A. CALKIN A. CALKIN J. MILLER BRIAN 14 8th SCI. SKILLS

11 CAPITAL CITY SCHOOLS, TOPEKA, KS. BRIAN/J. MILLER BRIAN 12

Learning Pictures May Be Related to Other Behaviors

Teaching methods and interventions are not the only cause for abrupt changes. Circumstances outside the classroom may provide change in the learning pictures. The charts can give information when a student may be having some sort of change or problem.

An example of this is Sarah's Standard Celeration Chart (see Figure 5) Sarah, a resident patient of the State Hospital, had maximally improving learning pictures through the first three phases. During phase 4, science facts #2, her learning picture maintained until after Christmas vacation, when it showed improvement. The holiday season is time of anxiety for many hospital residents. Sarah was going home during this time and the anticipation of getting away from the hospital to be with her family affected her learning. When things became more routine for Sarah after the holidays her learning again improved.

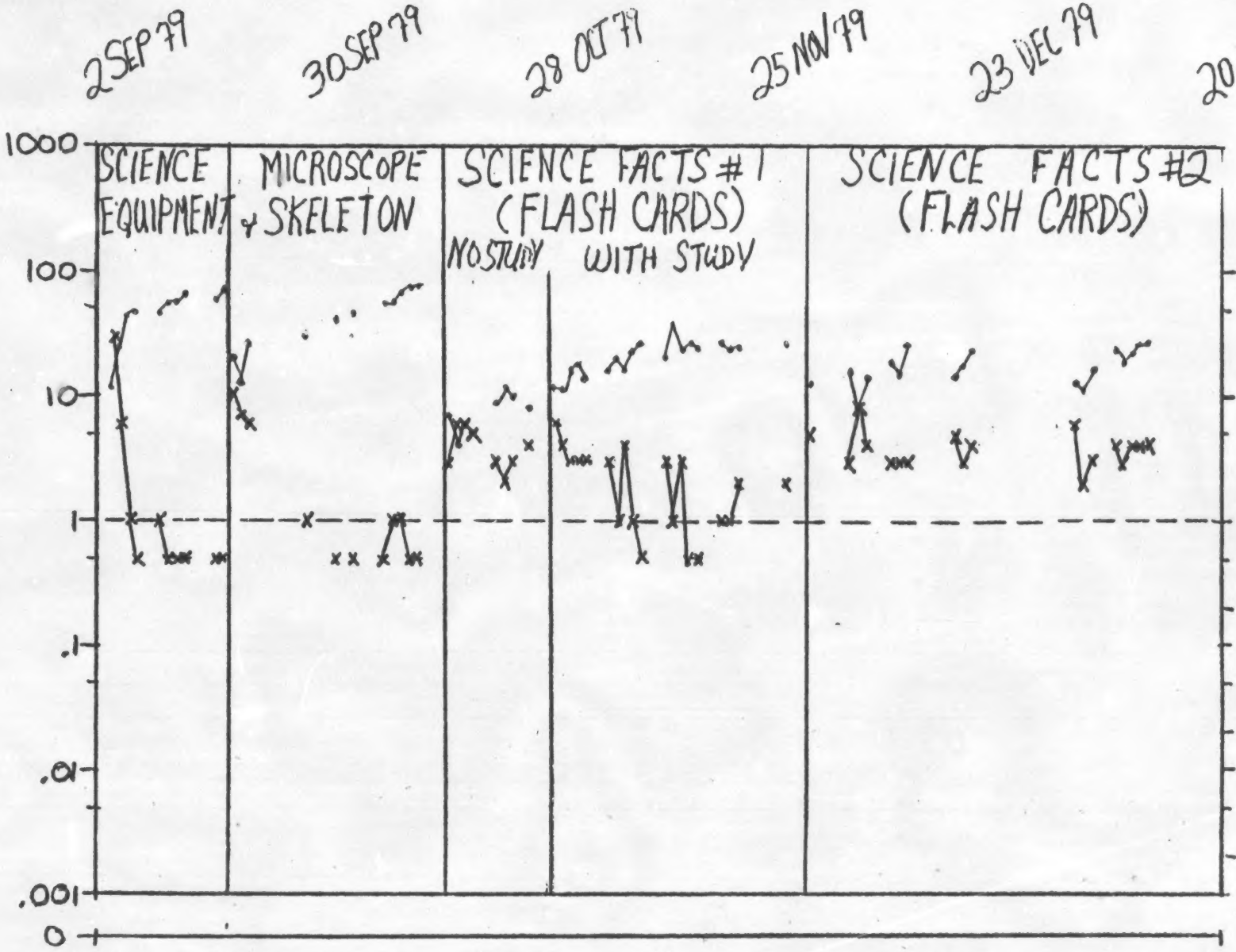

FIGURE 5.

A. CALKIN A. CALKIN J. MILLER SARAH .14 9th SCI. SKILLS

CAPITAL CITY SCHOOLS, TOPEKA, KS. SARAH/J. MILLER SARAH

A Measure of Teacher Accountability

All the student's learning pictures may be superimposed to give the teacher a pictoral collection. In the learning picture collections in Figures 6 and 7 the extended line in each phase represents the median celeration line. The value of that median is written below the celeration line collection for each phase. In figure 6, the median celeration for correct answers on science equipment increased x2, or doubled each week. The microscope and skeleton correct answer median celeration increased by x5.5 per week. Figure 7 shows the median celeration for errors on science equipment was ÷3.6. In Figures 6 and 7 we have the widest jaws in the microscope and skeleton phase. This shows the teacher that the students liked something they could put their hands on and that they could see. Perhaps science should be a "hands-on" activity.

Looking at this data collection from a numerical rather than a pictoral view, the teacher counted the different kinds of learning pictures. The student's learning pictures showed 61 phases were maximally improving, 14 improving, 9 maintaining, and 8 worsening. The teacher concluded from this that she also can learn if she remains accountable as a teacher.

A comment taken from Greg's report on timings summarizes Precision Teaching from a student's viewpoint. Greg wrote, "I feel that all these tests help me in understanding my science work. I understand technical words and meanings. They have helped me to use the right equipment for experiments and how to use a microscope properly. Also, I can see these timings helping other kids. Since these kids are competing, it makes them study so they can beat their classmates. I feel that is good incentive because the kids have fun doing it."

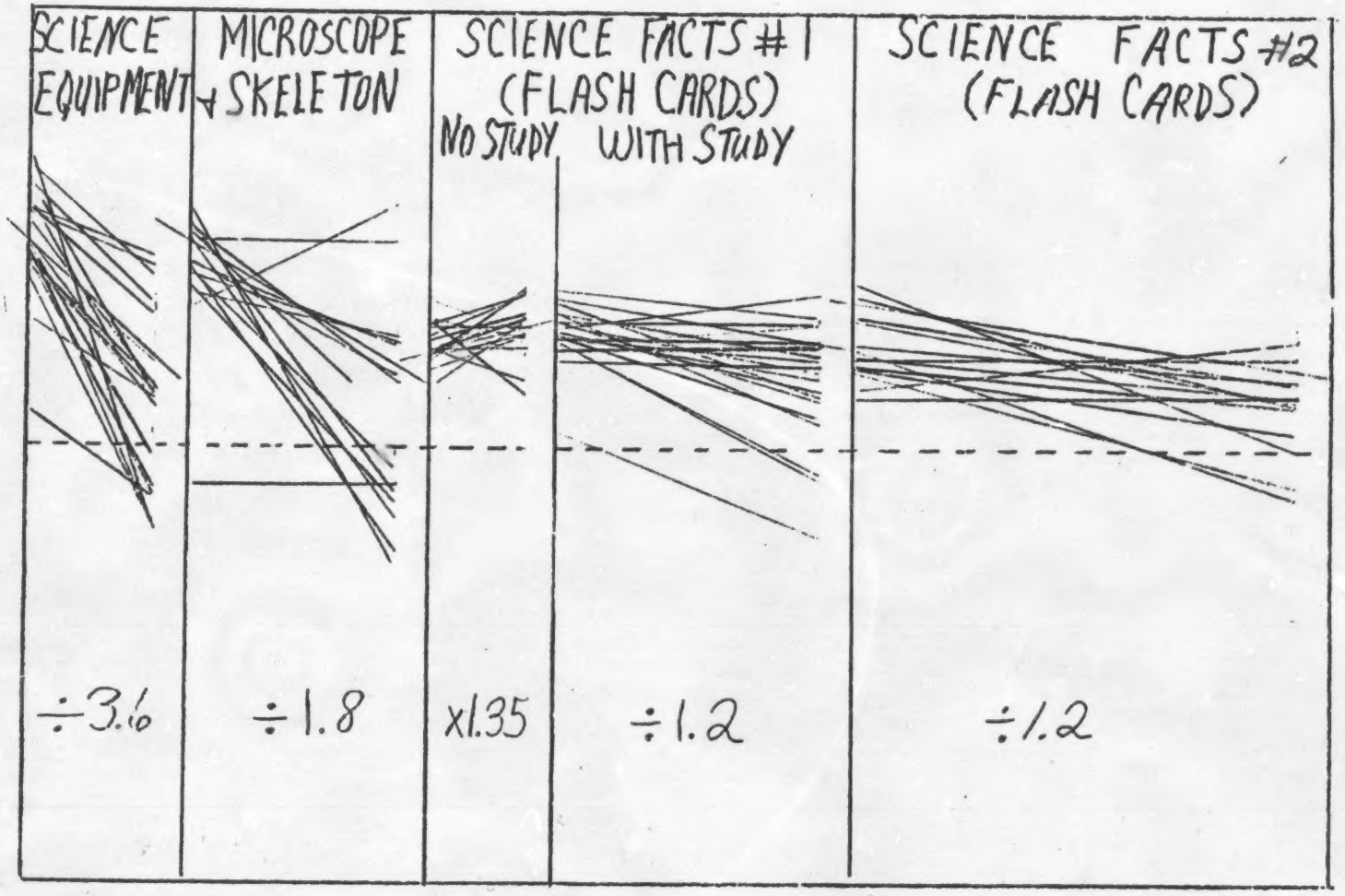

FIGURE 7.

CELERATION COLLECTION – INCORRECT